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ABSTRACT

This paper addresses a range of issues that teachers must consider when designing and developing a World Wide Web-enhanced course. It offers a guiding philosophy for Web-enhanced course design, presents a discussion of improved instruction and course management, outlines design issues that are involved for a course Web environment, and proposes the pedagogical benefits which can accrue for student and teacher. Students will become more active learners as they take responsibility as co-discoverers of knowledge. Instruction will improve as it becomes more flexible, relevant, and interactive. Course materials will evolve along with the supporting technology. (Author/AEF)

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Weaving the Web into the Classroom: An Evolution of Web Enhanced Instruction

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Abstract: This paper addresses a range of issues that teachers must consider when designing and developing a Web-enhanced course. It offers a guiding philosophy for Web-enhanced course design, presents a discussion of improved instruction and course management, outlines design issues that are involved for a course Web environment, and proposes the pedagogical benefits which can accrue for student and teacher. Students will become more active learners as they take responsibility as co-discoverers of knowledge. Instruction will improve as it becomes more flexible, relevant, and interactive. Course materials will evolve along with the supporting technology.

Introduction

Just as the technology of previous decades such as audiocassettes and videotapes has impacted the role of the classroom teacher, the growth of Web-based courses will have a major effect on the classroom (Dugan, 1998). For education, Web-based and Web-enhanced courses are one of the fastest growing areas on the World Wide Web (Kaplan, 1997). To keep pace, educators are faced with diverse and difficult challenges ranging from the technical to the pedagogical. This paper will discuss what two Web developers have learned and are continuing to learn about what may turn out to be the most revolutionary innovation since the invention of the printing press. The discussion of courses designed for the Web should be of interest to educators, regardless of discipline, who believe that technology can improve the way they teach and the way students learn.

An underlying goal of a Web enhanced course is to enable students to acquire the conceptual background and the online skills needed to achieve Internet competency and to awaken them to the Internet's incredible potential in education. The first major objective is to instruct students in the broad range of basic Internet services, such as email, listserv, telnet, FTP, and the WWW. A second objective is to challenge the students with innovative methods of course development and delivery via electronic means. The final thrust is to involve students in debate about the future of the Internet by discussing such issues as equity, privacy, security, censorship, and copyright.

As in any traditional course, students will continue to attend classes, listen to lectures, ask face-to-face questions, participate in individual and group projects (including hands-on computer exercises), and do homework. The learning enhancement is the opportunity to conduct research on the WWW, e-mail teachers and classmates, submit multimedia projects, practice critical thinking, and learn to "synergize" information in the

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non-linear environment of the network. Additionally, education students will be able to design and implement their own Web pages to apply the pedagogical concepts and tools learned in the course.

This course is designed to be presented by an individual with moderate competence in the use of all of the technological tools the students will be required to learn, plus a working knowledge of Instructional Technology theory and practice. Instructional Technology involves the design, development, implementation, management and evaluation of processes and resources for learning. Because the course will change frequently, the teacher must be willing and able to learn to use the current and emerging crop of Internet tools. The course is designed to augment the skills of any undergraduate education student who expects to work in a school setting requiring interactions with modern information technology. A basic requirement is that every student has individual access to an Internet-connected PC and that each PC is equipped with the full range of software applications to be taught.

This Web-enhanced course has evolved from the initial version that merely placed print-based materials on the Internet, to later versions that included research projects and constructive activities such as student Web page creation. It is now directed to a future, fully interactive experience that will enable online testing with immediate feedback, concept building sessions, and an online discussion forum. The ultimate goal from the standpoint of teacher education is for both future and practicing teachers to understand how on a practical level the Internet can be interwoven into course development and implementation across all curriculums regardless of discipline or grade-level.

However, this wealth of activities manifests a range of issues that teachers must consider when designing and developing a Web-enhanced course. Several questions must be addressed.

- What is the guiding philosophy of Web-enhanced course design?
- Can the Web improve instruction and course management?
- What design issues are involved for a course Web environment?
- What additional pedagogical benefits accrue for student and teacher?

Each semester these questions should be revisited for appraisal based on student response to the course environment and technological advances. Ongoing student evaluations (via electronic means) and peer reaction provide two mechanisms of assessment that enable continuous quality improvement. This redesign is especially important since Web content and delivery is constantly evolving, as will be the Web knowledge base of incoming students.

Guiding Philosophy

Two inspirational "tales from school" provide initial motivation for laying a philosophical foundation. The first involves visualizing a 19th Century surgeon in a 20th Century operating room. The good doctor would literally be lost in a modern setting. Compare this image to a 19th Century teacher in a typical 20th Century classroom. With just a bit of content updating, the teacher would be ready to lecture in relative comfort, which is somewhat incongruous.

The second true story happened about 15 years ago in the Veterinary Program at Mississippi State University. Two students were having particular difficulty with a final exam. One student left the exam room, went to the library to research the answers, and came back to finish the exam. The second student merely made his best guess at answers he did not know. The outcome of the story was that the researching student was deemed to have cheated on his exam and was failed. The second student barely passed the exam. An illuminating question would be: Which vet would you want operating on your dog or cat--the one who researched the problem or the one who took his best guess? The next year the Veterinary Program required all students to own a laptop and have a connection to the Internet for research. The realization was that in any field with extensive information, research skills are more important than the ability to remember facts.

The two stories point to fundamental issues in education. Are teachers demonstrating skills that they expect students to learn, in particular, technical skills that we all agree are essential in an information-based society?

That is not to suggest that traditional skills such as oral and written communication should be neglected, just that we need competency with proven tools. More importantly, these navigation and application skills will contribute to the critical thinking and problem solving skills relevant to the digital domain and elsewhere. We want to help develop our students as self-directed learners who are comfortable with resources for problem solving. Rewards for exploring these resources must be built into the curriculum.

The second issue is one of learning models. Rather than view "the student as a vessel to be filled at regular intervals with knowledge," the Web-enhanced course should use as its learning model, "the student as a co-discoverer of knowledge with the teacher responsible for seeing that the discovery takes place." With this model the teacher and students will not be "strapped to a classroom if discovery can take place in different spaces, even cyberspace" (Ruth, 1997). Accelerated learning is not the goal; the computer is not a substitute teacher or a tutor with boundless patience. It is a personal access tool in an information rich milieu. Our courses must provide the impetus to master the new tools of the trade.

Improving Instruction and Course Management

Instruction is better if more efficient, more effective, or more appealing. Improvement on any of these three dimensions, without compromise to the others, yields better instruction. The following suggest how the Internet might improve instruction.

The Web appeals to students as a learning mode as it restores the intrinsic value in learning, i.e., *enjoyment*, as a more exploratory style is reinforced. The graphic imagery, the hyperlinked world, is both familiar as a style to the MTV generation and responsive to their curiosity. Additionally the creative aspect of building Web pages can provide the student with a positive, reinforcing experience. In even introductory classes Web page creation seems to appeal to students regardless of their personal interests or academic preparation. The students' personal Web sites provide a platform for their opinions, a gallery for their taste in art and music, an altar for their heroes and heroines. And through all of this creation and exploration, they are writing, connecting ideas, and with some guidance, becoming discerning.

More than ever before, the contemporary student is comfortable with technology and, in fact, expects it. Many of today's students are already using the Web for entertainment and peer communication, why not education? Unfortunately, in too many schools the token or ineffectual use of technology has not reflected its broad acceptance by today's young people.

The Web has been thought of as practical tool for distance education, helping students access educational resources without being in the classroom. It is also a way to give students, teachers, and administrators more flexibility, even in the traditional classroom. A set of basic course Web pages can be developed from existing materials if the educator is competent in the use of current word processing software. The development of "static" Webpages has become an end-user activity that can be easily learned due to the many good Web development software tools on the market. The teacher can make all class materials and resources readily available to any student at any time of the day or night, make easy adjustments and updates to assignments, and manage lesson information flow with less lead-time than a paper environment would provide.

The emergence of interactive Web modalities such as Active Server Pages with database backends provide the teacher an effective means of guiding and measuring individual student and class progress. These dynamic access and delivery methods can involve the student in a more active participation and provide for management of the feedback between student and teacher. The traditional, "static" Web page is used to deliver information and to provide links to other information sources. It cannot collect data such as student responses to a survey or quiz. It cannot record the pages accessed as the student navigates through an assignment. It cannot redirect the progress of a lesson in response to a student's entry in a tutorial or guided exercise. In contrast, an Active Server Page can store the student's responses in a database with the use of "forms" created in a word processor such as Word or contemporary database package, such as Access.

Active Server Pages could also be used to implement a guided lesson using control structures that the teacher can define, but this might require either some expertise on the part of the teacher or a third-party developer/vendor. The stumbling blocks to the use of the more sophisticated Active Web Pages have been the

difficulty of developing these pages by users who are primarily educators, not "techies," and the technical support that is needed at startup in the Web server environment. However, it can be reasonably expected that the software that supports Active Server Pages will soon be as easy to use as that which grade schoolers are using to develop their personal Web pages.

Web Enhanced Course Material Design

Designing materials to be viewed on a computer screen requires an awareness of the interrelation of visual composition and presentation to the student's understanding and motivation. Five principles of graphic user interface design that come into play for a Web environment are the use of metaphors, direct user manipulation, consistency and perceived stability, feedback dialog, and aesthetic integrity.

Since people have more experience in the real world than with computers, using metaphoric icons helps users more quickly learn basic navigation, and retain a sense of organization more readily. Just as Microsoft Windows incorporates the "desktop" metaphor, a Web site must have a predominate theme such as a site map of course materials or a "book" icon linked to a table of contents.

Users want to feel that they are in charge of the computer's activities. Telling users their options by providing visible choices and ways to make their choices are necessary design elements. Effective screens are both consistent within themselves and consistent with one another. The look, usage, and screen behavior should be the same throughout. Users feel comfortable in a computer environment that remains understandable and familiar rather than changing randomly. They need reference points that provide both visual and conceptual stability. Even as the environment changes, familiar landmarks provide an illusion of stability.

User activities, which may be complex if taken together, should be simple at any given moment. The user must be kept informed by immediate feedback. If an operation cannot be performed, or if there is an error, the user must know it. Visually confusing or unattractive displays detract from the effectiveness of human-computer interaction. As much as possible, commands, features, parameters, choices, navigational options, and data should appear as graphic objects on the screen.

Design must also consider the possibility that visual elements and non-discriminating choices can become a distraction in a learning environment if they do not support the primary objective of a particular educational activity. This possibility has to be weighed against the reinforcing value of overall enjoyment and the stimulation of the exploratory, free associative method. These are the questions that must be considered: What will the student absorb? How will the experience build their knowledge base, feed analytical processes, and stimulate creative reflection?

Pedagogical Benefits

Using the Internet to enhance a course involves a changing pedagogical paradigm. The first change is from seat or time based education to a lifelong learning model. Class attendance is far less important than learning a set of skills and concepts such as information acquisition, processing, and evaluation. The new paradigm might be termed "network learning" as opposed to classroom centered instruction or achievement based education. Students become part of a community of learners/scholars by participating in and contributing to the universal repository of knowledge. Of course, this learning model requires more independence and self-motivation, and some students do not consider themselves computer literate and can be intimidated by the online materials.

Just placing traditional course materials on the Web, by itself, does not add anything of pedagogical value. If students can simply print out the Web materials, the only gain is passing part of the paper budget from your department to the computer lab. The best way to evaluate whether value is added is to assess "the extent to which the material cannot be reproduced in the older medium" (Fraser, 1998).

Perhaps the most enjoyable reward of redesigning course delivery is the new personal challenge. The teacher becomes a learner along with the students. It also fits a responsive style, so that last minute updates are easy and

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overall course material lead time is reduced. In this new paradigm, we need to change from being the "Sage on the Stage" to being the "Guide on the Side."

Critics of the technology-intensive model of course delivery state that it decreases the interaction between students and faculty. Encouraging the use of e-mail for "anytime, any place" questions can actually increase interaction, albeit asynchronously. In particular, shy students who would never raise a hand in class to ask a question or express an opinion, find e-mail an effective way to "speak up" and be part of the class discussion.

Conclusion

In a Web enhanced course students will continue to attend classes with traditional elements such as lectures, questions-and-answer sessions, and group projects . In learning to "synergize" information, students will acquire the lifelong skill of "knowledge navigation" and come to an awareness of the Web's importance in constructing the experience of education in an age of instant, global connectivity.

We must be patient with technology, even if at times it appears that it is not very patient with us. Computers are only 50 years old, the Web as we use it today, only five. In a 1985 keynote address to a national convention on computing in higher education, Nobel Laureate Herbert Simon pointed out that the impact of revolutionary inventions such as the railroad and computers takes time. It is not just time, but the effect of related inventions and the experience of using new technology that will determine the long-range effectiveness of its use. Simon suggested that computers can bring about a revolution in education only if their use is "accompanied by improvements in our understanding of teaching and learning (Kozna, 1991)." The Web may well become the launching pad for education in the 21st century, but the motivating interaction of student and teacher will continue to fuel the learning vehicle, and the creative leadership of educators must engineer its guidance system. To do this, future teachers, indeed today's practicing teachers, must be prepared for the new "space race" that will explore and expand the outer reaches of cyberspace as it interfaces with human intellect.

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